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Short Communication

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An innovation for organic crop production by compost fertilizer of Isfahan municipal's waste as bionematicide and biofertilizer

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Sugar beet cyst nematode (SBCN), *Hederodera schachtii* Schmidt. 1871, marked as one of the most damaging disease of sugar beet fields worldwide. Non chemical controls measures were carried out, using organic fertilizers including farm, poultry and green manure (waste cabbage leaves), compost (municipal's waste products, 0.15 and 0.08 mm in size) and vermicomposting as the soil treatments at various rates against control (no treatments) in glass house and field highly infested with the nematode, SBCN in Isfahan, Iran. The related data on cysts final population, number of eggs and second larvae per cyst and per gram of soil were subjected to statistical analysis. The reproduction factor and the percent reduction and or increasing in population of nematode, SBCN were taken into consideration in comparison to initial populations. The results revealed that, poultry manure at the rate of 40 t ha^{-1} had the most and highly significant effects on the final population reduction in contrast to other ones, including controls. Followed by 0.15mm (60 t ha^{-1}), compost 0.08 (60 t ha^{-1}), poultry manure at the rate of 20 t ha^{-1}, with no significant differences respectively. Vermicomposting, cabbage leaves and form manure treatments had the least effects on the final population reduction in sugar beet cyst nematode populations.

Keywords: compost municipality wastes, cyst nematodes, organic matters, Isfahan, Iran

1 Introduction

Sugar beet cyst nematode (SBCN), *Hederodera schachtii* Schmidt. 1871, is the most important disease of sugar beet in the field worldwide. This is also an important disease of sugar beet in Isfahan, Iran with plenty of irreversible damages to the value of this product. This nematode has a wide host range, over 218 plant species from 95 genera, belonging to 23 families, including crop species, ornamentals and weeds as hosts, which have already been identified and introduced so far. There are several nematode control including, crop rotation, use of catch crops, early planting and use of pesticides, nematicide. In general, the best reported way to control these nematodes (SBCN) is the 3 to 7-years rotation with non-host plants (Steel, 1986). In addition, studies on farm manure had a positive effect in controlling cyst nematodes, *Heterodera* spp. potato golden cyst nematode, *Globodera rostochiensis*. In this regard, reports on the use of organic fertilizers on the control of root knot nematodes and other ones have also already been proved (Singh and Sitaramaiah, 1973).

There are several reports on the use of compost fertilizers for the control of root knot and other nematodes, which have already been proved to some extent (Nasr Esfahani et al., 2010; Nasr Esfahani and Ahmadi, 1997). But, there is no factual report on the use of compost fertilizers for SBCN control so far. Therefore, with respect to this matter and reports,

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and also pollution problems, non-chemical studies were performed for the control and reproduction of the nematode *H. schachtii* on the SBCN infected fields around the Isfahan sugar factory in Isfahan, Iran. Where, the infested soils are depot by using compost fertilizer of two types, 0.8 and 0.15 mm., farm and poultry manure, waste cabbage leaves, and vermicomposting at various rates against control (no treatments) in glass house and a field highly infested with the nematode, SBCN at various rates as a bionematicide and growth promoting factors.

2 Material and Methods

The experiments were carried out in the glass house and a field conditions simultaneously. An experimental field with a long cultivation period of sugar beet and heavily SBCN infestation was selected in the area, around the Sugar Factory in Jaey and Qhohab, Isfahan, Iran. The same soil was also used in the glass house.

2.1 Initial population (PI) and final population (PF)

The initial population of SBCN in the infested soil was determined before the treatment of the field, in which, the plots (replicates) were created, with an area of 6 square meters per replicate. Then, 200 g of soil were selected out of several samples collected from every plot, which was air dried and the cysts were extracted, using Fenwick (Fenwick, 1945). Eggs and the second larvae in a 200 g of soil were calculated after crushing of the cysts and converting into gram of soil accordingly (Donny et al. 1969; De Bok, 1994).

It was performed two months after passing the treated plots, according to the method described in PI, in which, the populations of *H. schachtii* from the treated soils were determined by extraction and counting of the cysts and eggs and larvae numbers accordingly. The final population of eggs and larvae per gram of soil was calculated for each plot. Reproductive factors and the percent decrease and or increase in SBCN populations in each treatment were calculated relative to the initial population of the same treatment.

2.2 Treatments

All the organic matters, including the compost fertilizers by municipality of Isfahan wastes, vermicomposting, waste cabbage leaves and farm manure (cow dung) were incorporated into the soil at the rate of 20, 40 and 60 tons per hectare and poultry manure at 10, 20 and 40 t ha^{-1}, in a complete and randomized block design for green house and the field respectively.

2.3 Statistical analysis

The normality test for data distribution was assessed using SAS software. Homogeneity of variance within treatment was determined, using the Bartlett test. For the normality test, SAS software was tested again. And finally, the analysis of variance carried out by using SAS software and comparison method by DMRT on one percent level of probability (SAS Inst., 2004).

3 Results

The results showed that the compost fertilizers of Isfahan wastes municipality, 0.15 and 0.8 mm. at the rate of 60 t ha^{-1} with 87.51 and 85.92 % reduction of SBCN, had the most significant effects on the final population in comparison to the other's used ones in terms of rate and size respectively. Indicating that they are having nematicidal effects ($P = 0.01$). There was also increased growth response, IGR, almost two folds than, that of the controls and or checks. Though, the poultry manure at the rate of 40 t ha^{-1} with 92.4% reduction of SBCN had the greatest impact on the nematode control ($P = 0.01$), but there is question of cost benefit in terms of production. Then, followed by vermicompost at the rate of 60 t ha^{-1} with 82.30% populations reduction in eggs and second juveniles of SBCN. The poultry manure and compost treatments at 20 t ha^{-1} and 0.15 at 60 t ha^{-1} were not statistically

significant respectively, revealed that, having almost the same effects. But vermicompost at 20 t ha^{-1} with 62.9 %, and cabbage leaves treated at 60 t ha^{-1} with 60.79 % and farmyard manure at 20 t ha^{-1} with 37.8 % showed lowest percent of population control respectively. A noticeable results were found on the effects of various treatments, including compost, vermicompost and other used organic matter (P = 0.01), showing that, there is a significant reduction in population of the SBCN compared to the initial population in each treatment, as was compared with the controls (P = 0.01). The other treatments including farm yard manure with various amount and other respective treatments had lower effects accordingly. Based on the other sources, organic fertilizers include manure, in the control of tomato root knot nematodes, Meloidogyne javanica become even more effective in increasing growth and the yields (Poswal and Faull, 1989; Rodriguez and Kabana, 1986). Also, in Australia, the use of poultry manure in quantities of 24, 36 and 48 t ha^{-1} and in combination with urea fertilizer at the rate of 1800 t ha^{-1}., significant decrease the root knot nematodes species, M. incognita, and also had higher growth and the yields and greater control (Stiriling, 1989). The US reports had also shown that, increasing the amount of chicken manure to soil nematodes, there are further reductions of root knot nematodes, *M. arenaria* on tomatoes in the greenhouse (Kaplan and Noe, 1993). In Nigeria, the addition of chicken manure to the soil reduced the root-knot nematode, M. incognita on tomato crop and also higher IGR and or growth of the plants. It was also shown that, this reduction is caused by toxins produced from poultry manure into the soil (Chindo and Khan, 1990). Findings in North Korea on manure and compost alone and or with urea fertilizers in combination in the chili farm has shown that, root-knot nematodes were all partially effective on nematodes population (HyunGwan et al., 1995). In a study designed to assess the SBCN disinfecting contaminated soils at the sugar factory using solorization, manure and combining of both at the four various depth, showed that the effect of a combination of solorization and manure treated very well, especially in the zero to 15 cm depth and decreased 85.99 % of the SBCN infested soils were returned (Nasr and Esfahani et al., 2010).

4 Conclusions

These results indicating that, the Compost Fertilizers by Isfahan municipality wastes act as a biofertilizer and bionematicide, and also there are increased growth response at the rate of 60 t ha^{-1} by two folds in comparison to checks, and almost equivalent to usual used chicken manures.

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